3.E.1.a (2) (cont'd) composition, mechanical requirements, and subsequent heat treatment necessary. These specifications also prescribe certain destructive and nondestructive tests to ensure that the material meets these chemical and mechanical requirements and that the material is free from injurious defects. In addition, a mill or manufacturer's certificate is required by most specifications and by regulations. The majority of the materials accepted are those listed in Sections I, III, or VIII of the ASME Code and ASTM specifications accepted by ASME B31.1.

(3) Fabrication Requirements. It is not enough, however, to know that a designer has selected one of the acceptable materials to ensure satisfactory service. Subsequent fabrication methods (e.g., severe cold work, forging, and welding) used in the manufacture of the component may substantially alter the material's properties. Therefore, to help ensure that these manufacturing operations are not detrimental, the Coast Guard has adopted certain industry standards (e.g., Sections I, III, and VIII of ASME B31.1) and regulations, which place limitations and requirements on these operations. These requirements are not all encompassing, especially for certain products such as valves. In addition, these requirements do not always provide adequate guidelines in the selection of the material for certain service constraints, such as corrosion. However, unless specific requirements prevent the desired application of a material, the Coast Guard does not restrict the designer's selection (i.e., the adequacy of the choice will usually not be addressed).

(4) Headquarters Action. Commandant (G-MSE-3) is responsible for determining which materials are generally acceptable for boilers, pressure vessels, and piping systems and any limitations on their use; providing guidance to the field on the acceptance of other materials that are not generally accepted; and participating on national technical committees to develop material standards that meet USCG requirements for quality control and certification.

(5) Field Technical and Inspection Action. MSC personnel are responsible for determining that the material selected for a component meets Coast Guard requirements and is suitable for its intended purpose. This requires the reviewer to exercise considerable judgment when specific guidelines or standards are not provided. For this reason, the reviewer should become familiar with the basic materials used and their limitations. The reviewer must recognize that the suitability of a material not only depends on how it reacts in a given environment, but also how it reacts to certain fabrication methods and design details. Inspectors must ensure that only approved materials are used, and the fabricator adheres to the approved drawings and applicable standards, such as the ASME Code.

b. Evaluation Of Materials.

(1) Certification. 46 CFR 50.25 requires the certification of material, depending on the product, by the following methods:
(a) A manufacturer or mill certificate;
(b) An affidavit; and
(c) Specific letter and approved plan.

3.E.1.b (1) (cont'd) A manufacturer's or mill certificate is required for such products as plates, castings, forgings, bar stock, bolting, piping and tubing, and standard pipe joining fittings. This certificate is used to verify that the material complies with the basic requirements of a material specification and any supplementary requirements specified on the order. The certificate, as a minimum, shall report for each heat or lot the material specification and grade to which the material complies, along with the chemical analysis, mechanical properties, and any heat treatments to which the material was subjected.

(2) Testing. The material specifications accepted require certain tests to be performed to ensure that the material has the desired properties. These tests depend on the type of product and its expected service. Most material specifications accepted require a chemical analysis and tension test. Other tests that may be required include:

(a) Impact tests for materials used in low temperature service;
(b) Bend tests for plates;
(c) Flattening tests for pipes;
(d) Certain nondestructive tests for castings and welded pipes;
(e) Hardness testing for heat treated materials; and
(f) Certain chemical tests to determine the material's susceptibility to corrosion.

When called out in the basic portion of the material specification, these tests must be performed on all heats of materials produced. It is interesting to note that the only things that may separate one material specification from another are the types of basic tests required (e.g., ASTM A576 and A675).

Most material specifications provide for tests in addition to those required in the basic specification. These supplemental tests may be required by the purchaser to ensure that the material has certain properties required for a specific application (e.g., low or high temperature service). The buyer must purchase a sufficient quantity of material (usually a mill run) to have the mill perform the tests and guarantee that the material will have the desired properties. This is done because the mill may have to use different melting practices, tighter controls on certain elements, etc., to meet the additional test requirements with greater confidence. For this reason, it is difficult to require a manufacturer to purchase material with supplemental test requirements. The reviewer should take this into account prior to making such a request.

(3) ASTM and ASME Specifications. The majority of material standards are developed by the ASTM. The ASTM has thousands of standard specifications in effect. These standards are published in a multi-volume set known as the Book of ASTM Standards. A great many of the ASTM standards are reprinted or specified by various building codes such as the ASME Code, which adopts many of the ASTM standards without changes. However, some ASTM standards are adopted with minor to major changes. These changes usually

3.E.1.b (3) (cont'd) involve the requirement for a material certification, the deletion of certain melting practices, changes in lot size, deletion of certain grades, etc. The ASME material standards are published in Section II of the code. Section II contains three parts: Part A - Ferrous Materials; Part B -Nonferrous Materials; and Part C - Welding Rods, Electrodes, and Filler Metals. Appendix B of Section VIII, Division 1 of the ASME Code outlines the code policy for approval of new materials. To facilitate identification, the material designations used by ASME are similar to those used by ASTM (e.g., ASME SA516 and ASTM A516 are similar materials).

(4) Equivalencies. 46 CFR 50.20-30 and 56.60-1(a)(2) permit materials other than those generally accepted to be used, provided they receive specific approval of the Commandant. This authority has been delegated to the MSC in the course of plan review. The task of determining the suitability of a material for a specific application is difficult. The task of determining the suitability of a material for a specific application material involves comparing the material with one that is generally accepted to get as close a match as possible. The differences are then analyzed for their relative importance to the specific application. If they are considered to be substantial, the material is either rejected or accepted with the provision that the requirements of the generally accepted material are met. The following is a list of some of the items that should be considered:

(a) Chemical requirements;
(b) Mechanical requirements, including location and configuration of the test specimens;
(c) Melting practices;
(d) Heat treatments;
(e) Quality control provisions;
(f) Fabrication processes;
(g) Design margin; and
(h) Directions of principal stresses, especially for plates.

[NOTE: These items are so interrelated that it is impossible to provide specific guidelines for their consideration.]

(5) Foreign Specifications. The majority of foreign material specifications reviewed for equivalency are Japanese Industrial Standards (JIS), British Standards (BS), and Deutsches Institute fur Normung e.v. (DIN). In general, the basic format of these specifications is similar to that of ASTM standards. Other than obvious differences in chemical and mechanical requirements, the reviewer must be careful to note the differences in test specimen size and other quality control provisions; for instance, in JIS 3101, the percent elongation for plates less than 5mm thick is based on a test specimen that has no ASTM equivalent. The JIS specimen with its shorter gauge length (50mm) would measure a higher percent elongation for the same thickness than the 200mm gauge length ASTM specimen. However, the JIS specimen's smaller width (25mm) and, therefore, smaller cross sectional area would measure a smaller percent elongation than the 40mm wide ASTM specimen.